

REMARKS

Claims 1, and 4-12 are all the claims pending in the application. Applicants have herein canceled claims 2 and 3 and have added claims 5-12. Applicants respectfully submit that the claims define patentable subject matter.

Drawings

Applicants have herein submitted replacement drawing sheets of Figures 13 and 14. Figure 14 is now designated with the legend --Prior Art--. Figure 13 is now designated with the legend --Related Art--.

The Examiner has also objected to the drawings because the dimensions L_1 and S_A are not labeled in the drawings and reference numbers that appear in the description must be in the drawings. However, Applicants respectfully submit that the dimensions L_1 and S_A are referenced in the specification as they relate to the claimed inequalities and not merely as reference numbers. Furthermore, the specification describes L_1 as “a distance between the centers of the adjacent balls” (paragraph spanning pages 9 and 10) and S_A as an axial gap between the outer race and the inner race. It is submitted that one skilled in the art would understand these variables as described.

Specification

The Abstract of the disclosure is objected to because it should be a single paragraph in the range of 50 to 150 words. Applicants have herein submitted a new Abstract.

Claim Rejections - 35 U.S.C. § 103

Claim 1 is rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Kabayashi (U.S. Publication 2002-0037123) in view of Iwata (JP 2001-304273).

Applicants have herein amended claim 1 to recite “the balls are made of engineering ceramics; and a surface of each of the balls has Vickers hardness H_v ranging from 1300 to 2700.”

Kabayashi does not disclose the claimed hardness of the surface of each of the balls.

Since the claimed Vickers hardness of the ceramic ball is higher than those of a SUJ ball and a stainless steel ball, the wear resistance of the ball against the differential slip is enhanced. More specifically, according to the claimed bearing, deformation of the ball, which is caused by the contact surface pressure acting between the ball and the raceway surface, is suppressed (see paragraph spanning pages 12 and 13). Consequently, the contact oval produced between the ball and the raceway surface can be reduced in size. Thus, the differential slip occurring between the ball and each of the raceway surfaces can be minimized.

Furthermore, the wear resistance thereof against a slip operation is enhanced (see first full paragraph on page 13). This enhancement of the wear resistance of the ball and the minimization of the differential slip enables the suppression of increase in the friction torque in an operation performed under a preload applied thereto. Thus, the generated heat and the wear of the bearing can be suppressed. Consequently, a low-noise and low-vibration operation at a high-speed rotation can be realized. Simultaneously, the enhancement of the bearing life can be realized by reducing the generated heat and the wear thereof.

Furthermore, it is respectfully submitted that it would not have been obvious to modify Kabayashi/Iwata to also include the unique claimed combination that includes the claimed

relationships of " $1.5 \leq L_1/d \leq 2.1$ " and " $-0.050 \text{ mm} \leq S_A \leq 0 \text{ mm}$ " as alleged by the Examiner on page 6 of the Office Action. Particularly, the Examiner alleges that it would have been obvious to provide the claimed axial gap because discovering an optimum value of a result-effective variable involves only routine skill in the art.

Applicants respectfully submit that Kabayashi does not recognize an axial gap as a variable that may be optimized to achieve the advantages of the claimed invention. As discussed in the specification, in an environment in which synergetic effects of operation and advantages of the claimed bearing, a preload condition suitable for realizing a low-noise and low-vibration operation at a high-speed rotation of the bearing is obtained by the claimed axial gap (page 10). Consequently, the bearing life can be prevented from being reduced due to heat generation and wear.

In light of the above, it is submitted that claim 1 is patentable over the art of record because the cited references do not teach or fairly suggest the claimed Vickers hardness and because it would not have been obvious to modify Kabayashi as suggested.

Added Claims

Applicants have herein added claims 5-12. Claims 5 and 6 are supported by page 24 of the specification; claims 7 and 8 are supported by pages 25 and 26; claims 9 and 10 are supported by pages 26 and 27; and claims 11 and 12 are supported by page 27. No new matter has been added.

These claims are patentable at least by virtue of their dependencies.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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